

## CLAIMS

What is claimed is:

1. A paper detecting apparatus of an image forming machine having a duplex printing function comprising:
  - an actuator pivotably disposed above a paper feed cassette and below a duplex printing paper path, that is moved by the paper; and
  - a paper sensor disposed next to the actuator that senses movement of the actuator and generates a signal,wherein the actuator pivots in a predetermined angle when no paper is stacked in the paper feed cassette or when paper is being fed along the duplex printing paper path, and the paper sensor generates a signal upon sensing the actuator pivot.
2. The paper detecting apparatus of an image forming machine according to claim 1, wherein the actuator comprises:
  - a hinge shaft;
  - a center pivotably assembled around the hinge shaft;
  - a first lever extending from the center that operates the paper sensor when no paper is stacked in the paper feed cassette;
  - a second lever at a predetermined angle from the first lever, that operates the paper sensor when paper is fed along the duplex printing paper path; and
  - a third lever, extending from the center and away from the first and second levers, weighing more than the combined weight of the first and second lever to have a tendency to pivot downward.
3. The paper detecting apparatus of an image forming machine according to claim 2, wherein the predetermined angle is determined so the second lever does not operate the paper sensor when the third lever is in contact with paper on the paper feed cassette.
4. The paper detecting apparatus of an image forming machine according to claim 2, wherein the paper feed cassette has a slot that allows the third lever to pass through.

5. The paper detecting apparatus of an image forming machine according to claim 1, further comprising a stopper limiting pivoting space of the actuator.

6. The paper detecting apparatus of an image forming machine according to claim 1, wherein the paper sensor is a photo sensor.

7. The paper detecting apparatus of an image forming machine, including a hinge shaft under a duplex printing paper path, comprising:

an actuator, having a center, pivotably assembled on the hinge shaft;

a paper sensor, having a sensing area;

a second lever extending from the center and interfered by the paper when the paper moves along the duplex printing paper path;

a first lever extending from the center at a predetermined angle from the second lever ;  
and

a third lever extending from the center and away from the first and second levers and heavier than the combined weight of the first and second levers, wherein

the third lever pivots downward so the first lever is normally located inside the sensing area of the paper sensor when no paper is stacked in the paper feed cassette, and

the second lever pivots into the sensing area of the paper sensor, and then escapes from the sensing area of the paper sensor due to the weight of the third lever when paper moves along the duplex printing paper path.

8. The paper detecting apparatus of an image forming machine according to claim 7, wherein a rear end of a slot formed in the duplex printing paper path interferes with the second lever when the first lever is located inside the sensing area of the paper sensor.

9. The paper detecting apparatus of an image forming machine according to claim 7, wherein the second lever is not located inside the sensing area of the paper sensor when the third lever is in contact with paper stacked in the paper feed cassette.

10. The paper detecting apparatus of an image forming machine according to claim 7, wherein the paper sensor is a photo sensor.

11. A paper detecting apparatus of an image forming machine, including a hinge shaft under a duplex printing paper path, having a slot, a paper feed cassette in which paper is normally stacked, and a sensor having a sensing area, comprising:

an actuator, having a center, on the hinge shaft;

a first lever extending in a first direction from the center of the actuator;

a second lever extending in a second direction from the center of the actuator such that a free end of the second lever extends into the first slot of the duplex printing path;

a third lever extending in a third direction from the center of the actuator, wherein the third lever causes the actuator to pivot such that the first lever enters the sensing area of the sensor when the paper is not stacked in the paper feed cassette, and allows the actuator to pivot such that the second lever enters the sensing area of the sensor when the paper moves along the duplex printing path.

12. The paper detecting apparatus according to claim 11, wherein the actuator is shaped like a letter "Y".

13. The paper detecting apparatus according to claim 11, wherein the slot in the duplex printing path comprises a rear end.

14. The paper detecting apparatus according to claim 13, wherein the slot in the duplex printing path has a length so the rear end of the slot acts as a stopper for the second lever to limit a pivoting space of the actuator when no paper is stacked in the paper feed cassette.

15. The paper detecting apparatus according to claim 11, wherein the third lever maintains contact with an upper surface of paper stacked in the paper feed cassette.

16. The paper detecting apparatus according to claim 11, wherein the paper sensor is normally between the first and second levers when the paper is stacked in the paper feed cassette.

17. The paper detecting apparatus according to claim 11, wherein the paper sensor includes a limited switch.

18. The paper detecting apparatus according to claim 11, wherein the sensor comprises a photo-sensor.

19. The paper detecting apparatus according to claim 11, further comprising a paper pressing plate having a slot into which the third lever freely pivots when no paper is stacked in the paper feed cassette.

20. The paper detecting apparatus according to claim 11, wherein when the paper is stacked in the paper feed cassette, the first and second levers are normally forced out of the sensing area of the sensor.

21. The paper detecting apparatus according to claim 20, further comprising a paper pressing plate in the paper feed cassette to maintain the paper in the paper feed cassette at a predetermined height as paper is fed from the paper feed cassette into the image forming machine.

22. The paper detecting apparatus according to claim 21, further comprising a slot in the paper pressing plate, wherein when the last paper is fed from the paper feed cassette, the third lever pivots into the slot, thereby causing the first lever to enter the sensing area of the sensor.

23. The paper detecting apparatus according to claim 22, further comprising a rear end of the slot in the duplex printing path to stop the second lever from pivoting.

24. The paper detecting apparatus according to claim 23, wherein when the first lever enters the paper sensing area of the sensor, the sensor generates a signal that no paper remains in the paper feed cassette.

25. The paper detecting apparatus according to claim 24, wherein the image forming machine receives the signal from the sensor, and compares a length of the signal with a standard length.

26. The paper detecting apparatus according to claim 25, wherein if the length of the signal is shorter than the standard length, the image forming machine judges that the paper is being fed along the duplex printing path.

27. The paper detecting apparatus according to claim 25, wherein if the length of the signal is longer than the standard length, the image forming machine judges that no paper remains in the paper feed cassette.

28. The paper detecting apparatus according to claim 21, wherein when the paper moves along the duplex printing paper path after being fed into the image forming machine, the paper impacts the second lever, thereby causing the second lever to pivot into the sensing area of the sensor.

29. The paper detecting apparatus according to claim 28, wherein when the impact between the paper and the second lever dissipates, the third lever causes the second lever to pivot out of the sensing area of the sensor.

30. The paper detecting apparatus according to claim 29, wherein during the period when the second lever is inside the sensing area of the sensor, the sensor generates a signal that the paper is being fed along the duplex printing path.

31. The paper detecting apparatus according to claim 30, wherein the image forming machine receives the signal from the sensor, and compares a length of the signal with a standard length.

32. The paper detecting apparatus according to claim 31, wherein if the length of the signal is longer than the standard length, the image forming machine judges that no paper remains in the paper feed cassette.

33. The paper detecting apparatus according to claim 31, wherein if the length of the signal is shorter than the standard length, the image forming machine judges that the paper is being fed along a duplex printing apparatus.

34. The paper detecting apparatus according to claim 31, wherein when a rear end of the paper being fed along the duplex printing path leaves the slot of the duplex printing paper shaft, the second lever enters the slot in the duplex printing path.